
MO1001 Optical Node

Installation manual



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1. GENERAL GUIDE

MO1001 device is COMTECH Ltd's compact optical node in die-cast housing with an exchangeable return path optical transmitter module. This optical node has a built-in forward path optical receiver. The RF signal is boosted by 1GHz GaAs or GaN Power-Doubler hybrids. At the end of the amplifier chain works a high-level output that can be used for power inserting too. The node can be connected to HMS or Comtech monitoring system by the right type of transponder.

1.1 ORDERING INFORMATION

M	O	1	0	0	1	X	X	-	X	X	-	X	X	-	X	X	X	X	-	X	X		
						▼					▼					▼							
						Amplifier-module type								Laser type		Wavelength (CWDM)							
						C	GaAs							0N	Without laser!	1270	1270 nm						
						D	GaN							1F	FP laser (1mW)	1290	1290 nm						
														2D	DFB laser (2mW)	1310	1310 nm						
														2C	CWDM laser (2mW)	1330	1330 nm						
														4C	CWDM laser (4mW)	1350	1350 nm						
																1370	1370 nm						
																1390	1390 nm						
																1410	1410 nm						
																1430	1430 nm						
																1450	1450 nm						
																1470	1470 nm						
																1490	1490 nm						
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																1590	1590 nm						
																1610	1610 nm						
						</																	

1.2 OUTSIDE CONTSTRUCTION

MO1001 optical node housing consists of two parts. In the bottom part there are three bays. The biggest one contains the RF mainboard with the RF as well as the optical ports. Behind this a medium sized bay contains the local or remote powered switching-mode power supply and a small bay in which the optional monitoring transponder can be placed. The lower and upper part of house can be fixed to each other by a screw. Between the surfaces there is a waterproof rubberfiller.

Figure 1 shows the open device's main parts (Attention! Device in picture is just an example so there could be differences between this and your device):



Figure 1: MO1001 optical node view from above

The MO1001 optical node is delivered with a chosen type of return path transmitter. On demand the device can be upgraded by changing the module with a higher power or with a different wavelength one. This can be done by removing metal lid of the RF bay. It is strongly recommended to let the above detailed procedure do by Comtech or by a contracted repair partner of Comtech. In case of unauthorized upgrade of the device the internal optical patchcables can be injured and the EMC sensitive parts can be damaged. In such a case the warranty voids!

On Figure 2 you can see the open device's main parts (Attention! Device in picture just an example so maybe there are differences between this and your device):

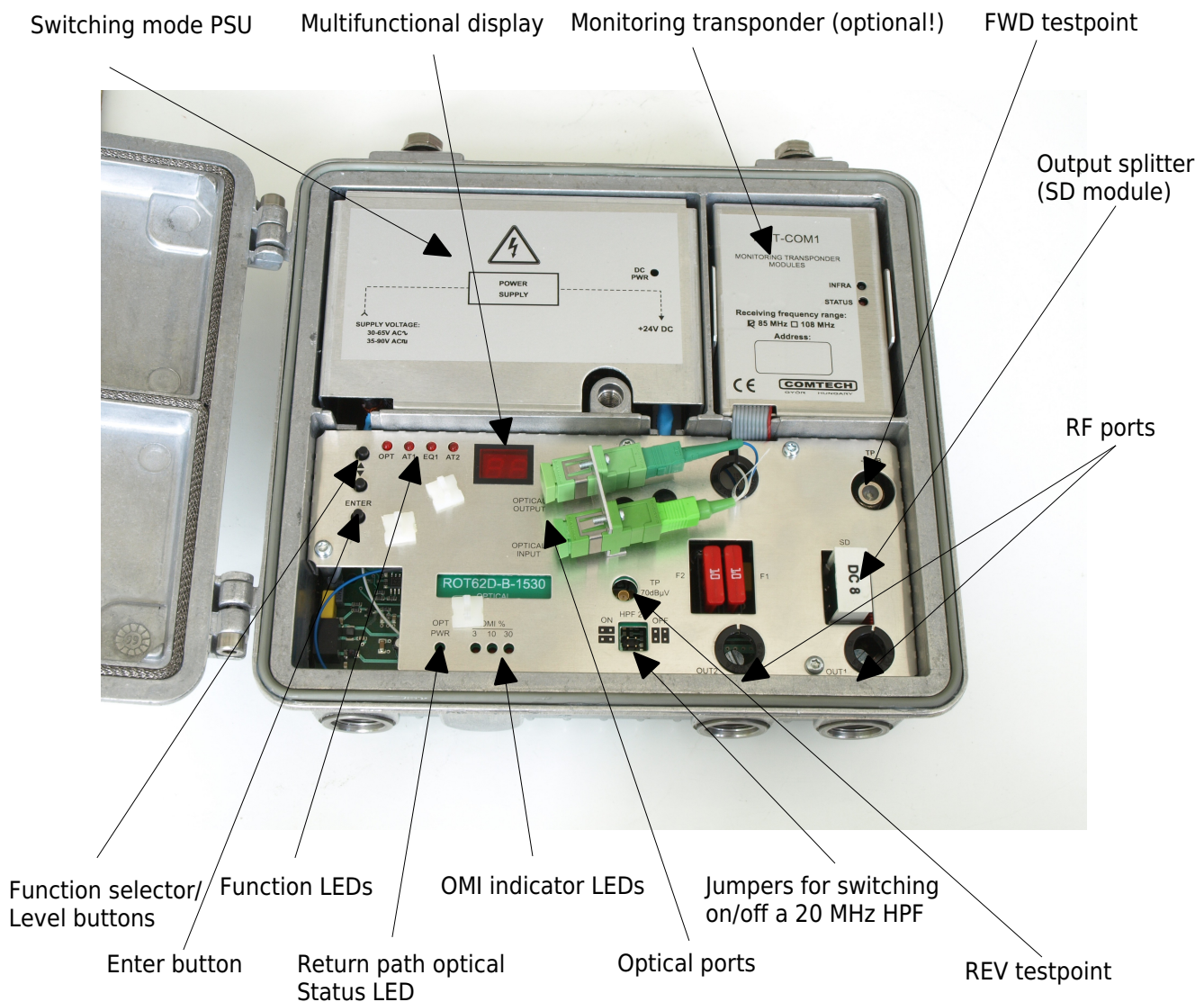


Figure 2: MO1001 optical node's physical construction

1.3 INSIDE CONSTRUCTION

Figure 3 shows the inside construction of MO1001:

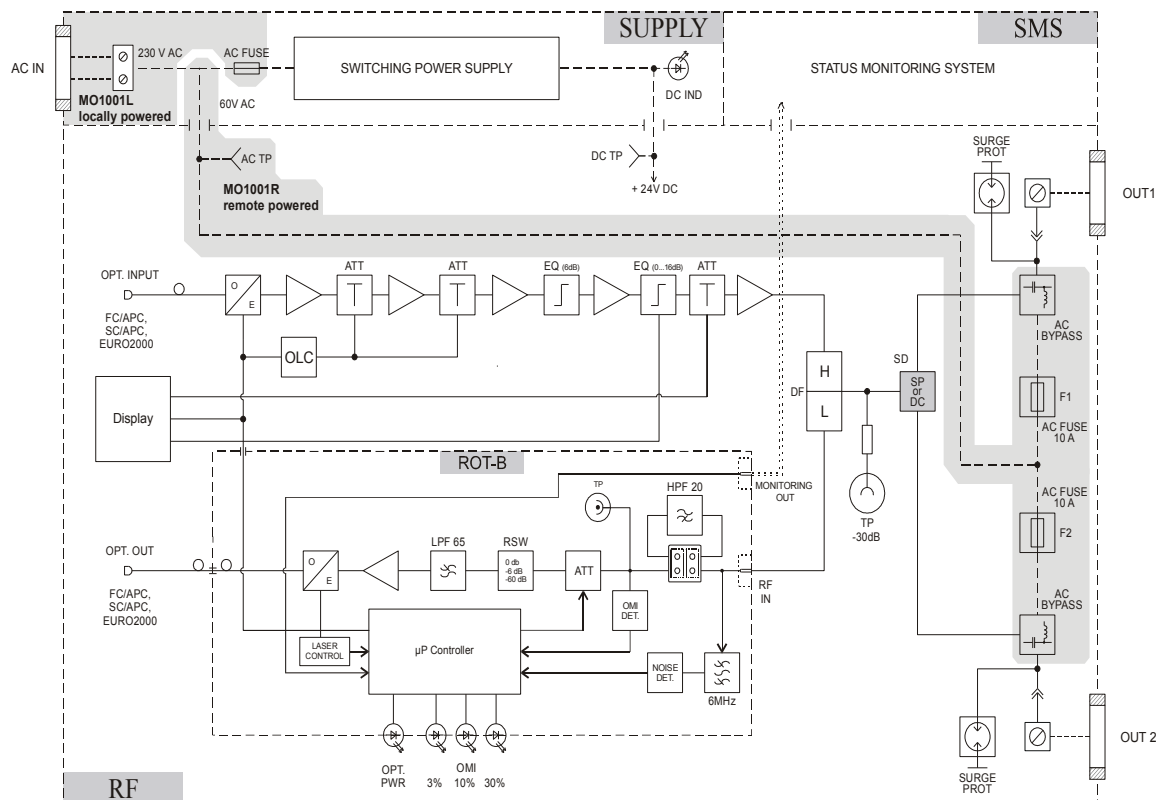


Figure 3: Inside construction of MO1001

The node has 1 high-level RF output. You can also connect here the remote AC power (at MO1001R type) via a coax cable. This output has a Test Point too – the measured level is -30dB correlated to the output signal level. The signal can be splitted into two simmetrically or asymmetrically by the SD module.

The device can be delivered with different type of return path module with or without LASER transmitter. This module communicates with monitoring system also and can be adjusted via optical node's microcontroller with the function selector / level buttons. Also this module has a Test Point for the return path.

The forward path optical receiver is followed by an automatically adjusted amplifier an equalizer and an attenuator module. At the end of the RF chain a changeable duplex filter is placed. After these in the transmission line the signal goes to the duplex filter, the available breakpnts are 30/47 MHz and 65/85MHz. (85/105 MHz is under construction, For more information please contact Comtech Ltd.)

2. INSTALLATION AND OPERATION GUIDE

ATTENTION!

Device contains an optical transmitter (ROT-B) and a built-in optical receiver. Avoid exposure to beam. Shut down the transmitter before any operation on device. Connection of non-used cables close with dust-protection plug!

2.1 INSTALLATION

After unpacking please check the node configuration. Open the top of cast after loosen the screw on lid. Check the modules and connections. The return path module can be checked through a window. If the node is delivered with a return path module, the type containing frequency band and the wavelength information is visible at this position. If you use a C-type (CWDM) optical transmitter, an external add-drop filter or CWDM multiplexer should be used. Take notice of this information when installing the node.



Figure 4: Information on the return path module

2.1.1 Fixing the node into a cabinet

Fixing the node to cabinet you can use the 2 handles on the bottom part of the housing (see figure 5).



Figure 5: Fixing handles on the bottom part of the housing

2.1.2 Fixing the node onto a pillar

If you fix the node onto a pillar you have to use the wire-rope on the pillar. You can find 2 wiresecures for this on the housing (see figure 6).

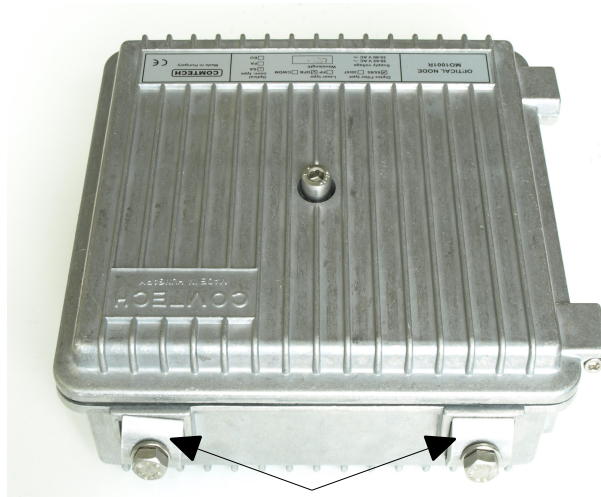


Figure 6: Wiresecures on the housing

2.1.3 Building in the modules, connecting optics and RF

The optical node is delivered with installed return path module, monitoring option and SD module if these are ordered. The SD module splits the output signal between the RF ports. If a J0 module is used all the output RF power comes to OUT1. An SP2 realizes symmetrical a DC module realizes asymmetrical splitting. In the second case the number at the end of the module type code gives the attenuation difference between the two outputs where OUT1 is the main output with higher level and OUT2 is the secondary output with lower level. Insert the module that corresponds the system plan into the SD module place.

If your cable network requires, a 20 MHz HPF filter in return path can be used. To switch on or off the filter place the jumpers regarding to the drawings on the lid.

The node has a fuse place for each RF port. By removing a fuse the remote power is blocked at the given output. At the remote powered type the power supply can be switched off by removing the fuses. The local powered type has fuse places for using the node as a power inserter up to 10 Amps. **This type is switched off only if the power cord is unplugged!**

The optical cables can be leaded in at the left side of the frontal surface via the hole with 5/8" screw-thread. A tightened 5/8" cable leader should be used at this position. The cables can be fixed by the plastic clamps on the lid. The forward path optical cable should be connected to the „OPTICAL INPUT”, the return path cable should be connected to the „OPTICAL OUTPUT”. The forward path input optical level can be checked on the multifunctional display (for detailed information check section 2.1.4). The first stage attenuator will be set by the OLC circuit automatically based on the measured optical power, the second stage attenuator (AT1) and the equalizer (EQ1) must be set by you based on the system plan. The return path optical modulation index is determined by the signal level and can be checked on the OMI LEDs. Set the OMI by using the return path attenuator (AT2). The return path optical status LED illuminates with green light after the short boot process. If this LED illuminates permanently with red light the return path optical transmitter module is damaged. In this case get in touch with Comtech Ltd.



Figure 5: Plastic clamps for cable fixing

2.1.4 Setting up the slope and level at the output

The output spectral parameters (slope and level) can be set by the electronically adjusted AT and EQ stages. This stages are controlled via the function selector / level buttons, the function LEDs and the multifunctional display. The LED is illuminating the function is active for readout (the value related to the function appears on the multifunctional display). To change the displayed value press the ENTER button. The LED is blinking the function is active for write. The displayed value can be changed by using the function selector / level buttons. As soon as the ENTER button is pressed the set value is applied. The following functions are available:

OPT - Measured value of the forward path input optical level in dBm. Since this value cannot be changed the ENTER button has no action.

AT1 - Set value of the forward path attenuator in dB. The step is 0.5 dB, a dot after the integer value on the display denotes the offset of +0,5 dB. For example 3 = 3.0 dB and 3. = 3.5 dB.

EQ1 - Set value of the forward path equalizer in dB. The step is 0.5 dB, a dot after the integer value on the display denotes the offset of +0,5 dB. For example 6 = 6.0 dB and 6. = 6.5 dB.

AT2 - Set value of the return path attenuator in dB. The step is 0.5 dB, a dot after the integer value on the display denotes the offset of +0,5 dB. For example 3 = 3.0 dB and 3. = 3.5 dB.

Example:

OPT LED is illuminating, forward path EQ value is 7 dB but should be 8.5 dB.

1. Press the ▲ button two times. >>> The EQ1 LED illuminates, the display shows „7”.
2. Press the ENTER button. >>> The EQ1 LED is blinking.
3. Press the ▲ button three times. >>> The display shows „8.”.
4. Press the ENTER button. >>> The EQ1 LED illuminates, the display shows „8.”.

The desired equalizer value is set.

3. MONITORING

3.1 MO1001 OPTICAL NODE IN MONITORING SYSTEM

MO1001 optical node can be connected to a Monitoring system. To do this you will need a monitoring transponder module (see figure 6). This module assures the communication with the monitoring server. The MO1001 node requires the NMT-COM1 transponder type. By using this option the status variables (see section 3.3.1) can be read out and the attenuators/equalizers (see section 2.1.4) can be set remotely.



Figure 6: Monitoring transponder module

The monitoring transponder is available with two different forward path frequency band. NMT-COM1-85-x works between 85 and 88 MHz, NMT-COM1-105-x works between 106 and 114 MHz. Return path carrier frequency can be set between 18 and 28 MHz at both types. **Befor building in a transponder into the node always check whether the frequency band is suitable for the duplex filters in your network!**

The monitoring transponder is available with two types of communication protocols. NMT-COM1-xxx-H uses the standard HMS protocol while NMT-COM1-xxx-C uses special protocol. The second one assures extreme high communication robustness and fully automatic setup but for this protocol you will need a Comtech HMTS termination system at the headend and a Comtech ComMon software. The HMS one can work with each standard HMS headend controller and standard HMS element management software.

3.1.1 Using the MO1001 with monitoring option in HMS network

The HMS network has standard variable structures. This is realized by MIB files that establish a connection between the number based OID's and human format variable definitions. (For more information check the HMS standard.) For the MO1001 you will need the following manufacturer-related MIB files:

- Comtech-HFC-Common-ELC.mib
- Comtech-HFC-Common-RSW.mib
- Comtech-HFC-Config.mib
- Comtech-HFC-FiberNode.mib
- Comtech-Root.mib

Some element management softwares need a special driver file instead of the MIB files. The driver files usually can be generated by using the MIB files. For more information please check the user manual of your management software.

3.1.2 Monitored values in the MO1001 optical node

The optical receiver table

This table is the extended version of the SCTE **fnOpticalReceiverTable** with the following entries:

- **cfnOpticalReceiverIndex**: Index of the optical receiver. Since this node contains only one receiver this value will be always 1. This is a read-only value.
- **cfnOpticalReceiverSlot**: The slot number in which the receiver module is placed. Since this node contains only one receiver this value will be always 1. This is a read-only value.
- **cfnOpticalReceiverTemp**: Temperature of the optical receiver module given in degrees Celsius. This is a read-only value. (Allowed range: -40...80)
- **cfnOpticalReceiverAtt**: Optionally variable that denotes the OLC state given in 0.1 dB. This is a read-only value. (Allowed range: 0...16)
- **cfnOpticalReceiverModuleType**: String with length of 32 that gives information about the receiver module.
- **cfnOpticalReceiverModuleSerialNumber**: String with length of 8 that gives the serial number of the receiver. At this type of node this number is equivalent with the serial number of the node. This is a read-only value.
- **cfnOpticalReceiverModuleState**: Gives the information whether the module is connected. At normal work the state should be connected (1). (Since MO1001 does not contain other receiver module at disconnected (2) state the communication with the headend equipment stops. This is a read-only value.

Return laser table

This table is the extended version of the SCTE **fnReturnLaserTable** with the following entries:

- **cfnReturnLaserIndex:** Index of the return path transmitter module. Since this node contains only one transmitter this value will be always 1. This is a read-only value.
- **cfnReturnLaserSlot:** The slot number in which the return path transmitter module placed. Since this node contains only one transmitter this value will be always 1. This is a read-only value.
- **cfnReturnLaserOmi:** The optical modulation index (OMI) of the return path transmitter in percents calculated from the return path input RF signal level. This is a read-only value. (Allowed range: 0...300)
- **cfnReturnLaserRef:** The reference output optical power for the return path transmitter module given in mW. This is a read-only value. (Allowed range: 1...4)
- **cfnReturnLaserModuleType:** String with length of 32 that gives information about the return path transmitter module (bandwidth, laser type, wavelength). This is a read-only value.
- **cfnReturnLaserModuleSerialNumber:** String with length of 8 that gives the serial number of the return path transmitter module. This is a read-only value.
- **cfnReturnLaserModuleState:** Gives the information whether the module is connected. At normal work the state should be connected (1). (Since MO1001 does not contain other return path transmitter module at disconnected (2) state the communication with the headend equipment stops. This is a read-only value.

RSW table

The MO1001 optical node is delivered with a built-in return path ingress switch (RSW). This is very useful when localising a faulty segment. (For more information see the ComMon documentetion.) Global values in connection with the RSW table:

- **rswNumbers:** Number of the RSW modules mounted in the device. Since this device contains only one RSW module fixed in the return path transmitter module this number is always 1. This is a read-only value.
- **rswAveragingTime:** Averaging time at the noise level measurement. Setting a high value causes eliminating of noise glitches. The value is given in 0,1 s, allowed range is 1...255 (0.1...25.5 s).

The RSW table contains the following values:

- **rswIndex:** Index of the return ingress switch module. Since this node contains only one transmitter this value will be always 1. This is a read-only value.
- **rswNoiseLevel:** Measured return path noise level at 6 MHz given in dBmV. This is a read-only value with a range of -50...30.
- **rswControl:** The set state of the return path ingress switch module. The following values are allowed in general at Comtech products.
 - **off (1):** The ingress switch is switched off, attenuation is minimum 60 dB.

- **min6dB (2):** The ingress switch is switched into 6 dB attenuator mode.
- **hpf (3):** In general a 20 MHz HPF is switched in cascade with the return path signal. **Since this type of return path transmitter uses jumpers for switching on/off the HPF this state is not allowed!**
- **auto6dB (5):** The ingress switch is switched into 6 dB attenuator mode if the measured noise level exceeds the given threshold limit.
- **autoHpf (6):** In general a 20 MHz HPF is switched in cascade with the return path signal if the measured noise level exceeds the given threshold limit. **Since this type of return path transmitter uses jumpers for switching on/off the HPF this state is not allowed!**
- **autoOff (7):** The ingress switch is switched off, attenuation is minimum 60 dB if the measured noise level exceeds the given threshold limit.
- **rswActualState:** The real state of the return path ingress switch. It depends on the rswControl value.
- **rswThresholdLimit:** Limit level for the measured return path noise level given in dBmV. If the measured level exceed this limit the action defined by the rswControl will be executed. (Allowed range: -30...30)
- **rswPortName:** Name of RSW controlled ports. If more than one exist, the names are comma separated.
- **rswModuleType:** Type of RSW module. The following values are possible:
 - **rtNormal (1):** Normal type of return path ingress switch without a 20 MHz HPF. **At MO1001 only this type is allowed.**
 - **rtH20 (2):** Return path ingress switch with a 20 MHz HPF.

Common parameters

These parameters are nonspecific values based on the standard MIBs. The measured value is 24 V DC power supply voltage, temperature, received forward path carrier level and return path transmitter carrier level, the other values are administrative and HMS control values. For more information check the HMS standard.

Alarm parameters

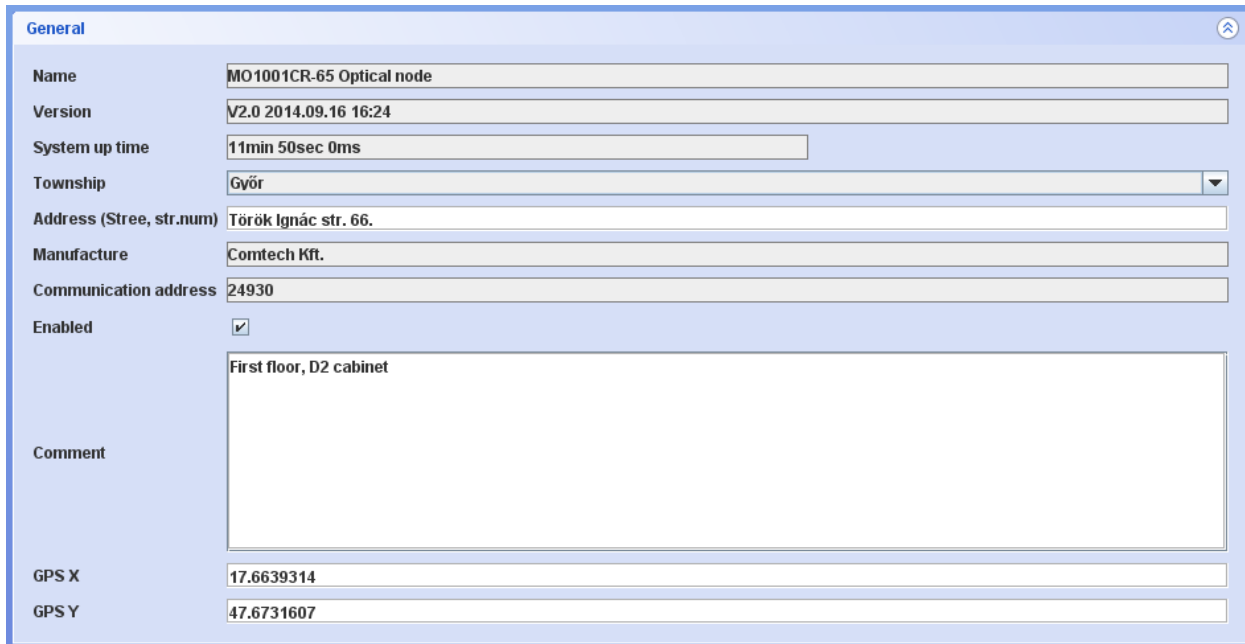
These parameters are nonspecific values based on the standard MIBs These are as follows:

- alarmLogNumberOfEntries
- alarmLogLastIndex
- alarmLogIndex
- alarmLogInformation
- alarmText
- hmsAlarmEvent

For more information check the SCTE standard.

3.1.3. Monitoring in ComMon system

ComMon is a compact graphical monitoring system. The managed parameter list is similar to the HMS type list. In this chapter the main views and available functions of the device in a ComMon system are described. Figure 7 shows the **General** panel with the most important identification data.



Name	MO1001CR-65 Optical node
Version	V2.0 2014.09.16 16:24
System up time	11min 50sec 0ms
Township	Győr
Address (Stree, str.num)	Török Ignác str. 66.
Manufacture	Comtech Kft.
Communication address	24930
Enabled	☒
Comment	First floor, D2 cabinet
GPS X	17.6639314
GPS Y	47.6731607

Figure 7: General panel

- Here are the device type as a **Name** and the Software **Version** shown. Since the type is stored in the EEPROM of the mainboard, no type selection is needed. The read line contains the whole type code that gives information about the bandwidth, the output stage, the power supply and the DF type. (Note, that in case of changing the DF, this code does not changes!) **Communication address** is a unique identifier in the system given by the manufacturer.
- **System up time** shows the time elapsed since the system start or since the last reset.
- The location of the node can be defined in 3 stages. First stage is the **Township**, the settlement name can be chosen from the predefined list. Second stage is **Address**, where the street and the street number can be fixed. The last stage can contain various and detailed information such floor number, cabinet identifier etc. under **Comment**. GPS coordinates also can be added to support a map search.
- By checking the **Enabled** checkbox the alarms originated from the MO1001 are received and the device management can be enabled. This checkbox is checked by default.

Figure 8 shows the **Amplifier data** panel. This panel contains overall measured variables in connection with a device independent from the device type. Since the example device is remote powered, the internal DC voltage originated from the switching mode power supply and the remote powering AC peak voltage are depicted. Both value have an allowed range, the input field of the lower limit of the range is filled with yellow, the input field of

the upper limit is filled with red. These limits are factory set to the values required by the device, and strongly recommended to leave them unchanged. If you have special restrictions for the remote powering voltage, more strictly limits, but never let looser tolerance than the predefined one. If the measured value falls out from the range defined by the limits and the device is enabled, an alarm event will be generated. (If a type of alarms is not needed, it can be switched off. For details check the manual of the ComMon system.)



Figure 8: Amplifier data panel

The details of the communication between the transponder and a Comtech HMTS are available on the Transponder panel. **Receiver frequency**, **Transmitter frequency**, **Receive level** and **Transmit level** are measured at the hardware interface between the transponder and the mainboard, and are set by the HMTS automatically. **Reverse path input level** is the level of the signals originating from the transponder but measured at the input of the HMTS. The **Communication statistics** gives how many percent of the communication packets arrived without errors. The fields in the lower right corner give the same information, the first number is the quantity of the injured packets, while the second number is the quantity of the correct packets. Both numbers can be cleared by clicking on the **Reset** button. This sets the Communication statistics to 100% in the same time. The yellow and red fields are alarm limits also on this panel, their work is the same as described above. Figure 9 depicts the Transponder table in case of alarm - the transponder should generate higher output level than allowed.



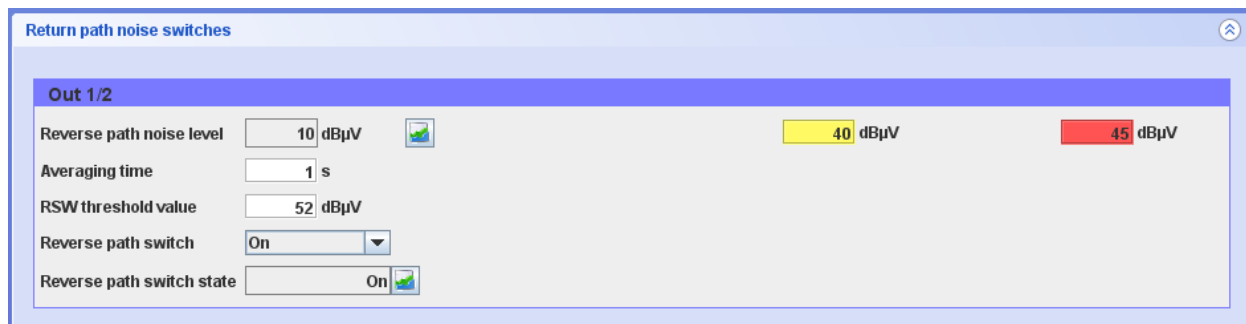
Figure 9: Transponder panel

The Temperature panel on figure 10 shows the measured temperature inside the housing.



Figure 10: Temperature panel

The MO1001 optical node has an integrated return path ingress switch mounted on the PCB of the laser module. This circuit measures also the noise level on 6 MHz (this frequency is encumbered by the short wave noises and contains no uplink carrier, so it is very suitable to indicate a shielding failure in the system). The measured value (**Reverse path noise level**) is available on the **Return path noise switches** panel. For the noise level two limits can be set, a limit for minor alarm (denoted with yellow) and a limit for major alarm (denoted with red). The noise level measurement is able to count an average. The higher the **Averaging time** value the less sensitive is the device for glitches. It is important to set this parameter correctly, because it not only the alarms generates, but also controls the ingress blocking switch. If the measured and averaged noise level excess the **RSW threshold value** the switch is driven into **6 dB** state in case of **Auto -6dB** setting and is driven into **Off** state in case of **Auto off** setting of the **Reverse path switch**. The switch can be controlled manually too via the **On, -6 dB** and **Off** settings. The actual state of the switch is seen in the **Reverse path switch state** field. (Note: if the described values are not present on the panel **RSW 1 module** must be checked under **Modules**.) Figure 11 shows an example with extreme low noise level.



Return path noise switches

Out 1/2

Reverse path noise level: 10 dBµV

Averaging time: 1 s

RSW threshold value: 52 dBµV

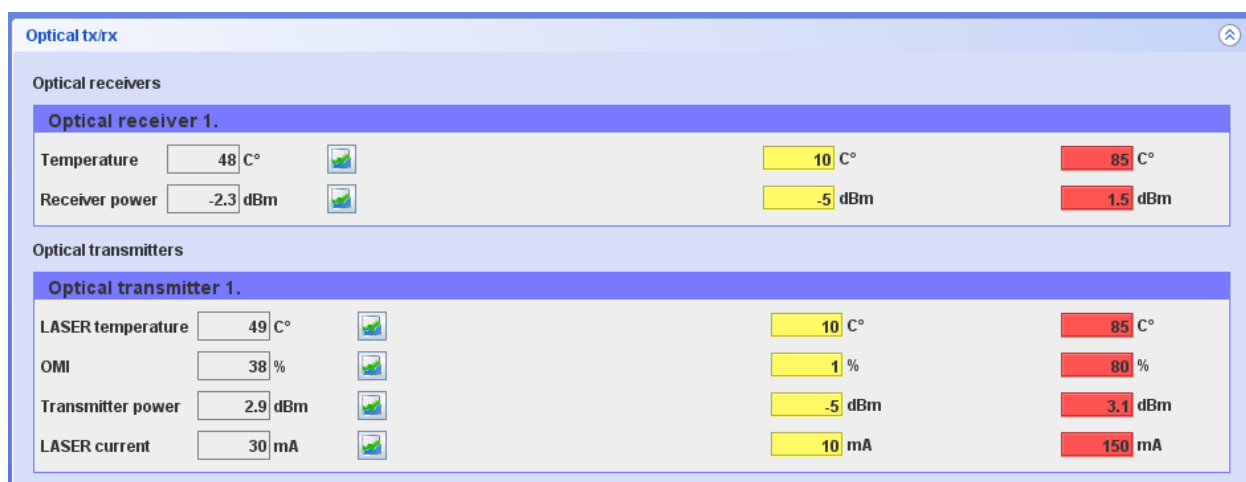
Reverse path switch: On

Reverse path switch state: On

Alarm thresholds: 40 dBµV (yellow), 45 dBµV (red)

Figure 11: Return path noise switches panel

The **Optical tx/rx** panel contains two subpanels, one for the receiver with the measured values of the module temperature and received power level, and one for the transmitter with the temperature, OMI, optical power and laser current as can be seen on figure 12.



Optical tx/rx

Optical receivers

Optical receiver 1.

Temperature: 48 C°

Receiver power: -2.3 dBm

Optical transmitters

Optical transmitter 1.

LASER temperature: 49 C°

OMI: 38 %

Transmitter power: 2.9 dBm

LASER current: 30 mA

Alarm thresholds (yellow/red):

- Temperature: 10 C° / 85 C°
- Receiver power: -5 dBm / 1.5 dBm
- LASER temperature: 10 C° / 85 C°
- OMI: 1 % / 80 %
- Transmitter power: -5 dBm / 3.1 dBm
- LASER current: 10 mA / 150 mA

Figure 12: Optical rx/tx panel

3.1.4. Getting the most important value at the optical node location

The most important data served by Comtech transponders can be achieved by using the IR1 infrared data reader. This device gives extra information over the measured values: the instantaneous scanning frequency and the registration state is displayed too. The IR1 can be used at the HMS and also at the ComMon system.

The devices with HMS software can be managed by a bidirectional USB connection. This allows to check the registration status, the MAC address, the temperature and the uplink frequency, further allows to check and modify the IP address, the downlink frequency, the uplink RF level and the frequency scanning status. For this the Comtech Monitoring Software Kit is needed.